

Avocado: post harvest handling

SOCOA-SHETRADES PRESENTATION

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Shelf life

- ▶ Is the period in which a product should maintain a predetermined level of quality under specified storage conditions
- ▶ Avocados continue respiring even after harvest, commencing the ripening process almost immediately due to their climacteric characteristic of high respiration rates
- ▶ Pre-harvest factors such as ambient field temperature and water stress affects the postharvest physiology of avocado fruit
- ▶ The postharvest handling treatments and environmental conditions that affect shelf life:
 - ▶ pre-packaging treatments, different density packaging films, storage conditions and cyclic temperature storage environments during the avocado fruit cold chain.
- ▶ Temperature was found to have the greatest influence on the physical, sensory and chemical quality of avocado fruit after harvest. Maintenance of an optimal temperature regime from harvest to final market destination is, therefore, required to maintain fruit quality

Pre-harvest and harvest factors affecting avocado quality

Respiration and ripening

- ▶ Respiration: a natural process occurring within all living organisms whereby organic materials are broken down into simpler end products. During respiration oxygen is expended and carbon dioxide liberated accompanied by the production of energy in the form of heat
- ▶ This process is predominantly responsible for the ripening of avocados.
- ▶ To improve handling of avocados once harvested it is essential to lower the respiration rates by reducing the temperature, increasing carbon dioxide and reducing oxygen concentrations within limits.

Pre-harvest factors

a. Ambient heat exposure

- ▶ Studies have demonstrated that the side of the avocado exposed directly to sunlight while still on the tree was able to withstand higher temperatures during postharvest treatments of approximately 50° C compared to the shaded side
- ▶ Avocados exposed to high ambient temperature on the field also demonstrated a tolerance to low postharvest temperatures and external chilling injury
- ▶ This will not apply to already harvested avocados as it is imperative that they be protected against direct sunlight to avoid overheating and subsequent early postharvest deterioration
- ▶ Sun exposed fruit showed a higher endurance to chilling injury when stored at 0° C for periods between three to six weeks.

b. Water stress

- ▶ Studies have shown that pre-harvest water stress resulted in premature fruit abscission and an increase in ethylene production leading to accelerated ripening by 40 and 25% depending on the degree of water stress
- ▶ It has also been confirmed that water stress decreased the normal avocado ripening time hence reducing the shelf life accompanied by an increased risk of physiological disorders
- ▶ Water stress reduces the internal quality of avocados due to the increased activity in polyphenol oxidase leading to browning of the flesh
- ▶ Lower concentrations of calcium were found in water stressed fruit resulting in high incidence of physiological disorders.
- ▶ Water stressed 'Hass' avocado trees were found to bear more elongated fruit

Summary of pre-harvest factors

Pre-harvest factor	Postharvest effect on fruit quality	Management
Climate or environment: temperature, wind and rainfall	Increased disease incidence, chilling injury	Pruning to expose the fruit to direct sunlight
Rootstock or scion	Susceptibility to physiological disorders during the cold chain, postharvest decay	Choose less susceptible rootstock or scion
Pruning practices	Poor fruit storability	Strike a balance between vegetative and reproductive growth and correct timing is important
Pest and disease management	Changes in fruit composition, influences the ripening behavior and decay development (anthracnose),	Maintain a clean orchard and correct application of chemicals is important
Plant nutrition (N/Ca)	Development of physiological disorders (mesocarp discoloration or grey pulp) and rots	Manage vegetative growth and avoid excessive nitrogen during fruit development
Plant growth regulators	Poor storability	Manage vegetative growth
Irrigation	Influences polyphenol oxidase levels thus mesocarp discoloration	Avoid water stress during fruit growth and development

c. Harvesting

- ▶ Avocados unlike other fruit do not ripen on the tree
- ▶ The time at which avocados are harvested plays an important role in maturation and the expected shelf life.
- ▶ Harvesting too early in the season contributes to low pulp dry matter. This is associated with irregular ripening, watery texture, flavorless, shriveled, blackened fruit, a low oil concentration and higher susceptibility to decay
- ▶ Studies have shown that harvesting at 21 and 24% dry matter leads to a higher cumulative and average yield on 'Fuerte' variety. Harvesting at 30% dry matter reduces yields by 26% and leads to alternate bearing
- ▶ Harvesting of 'Hass' variety at 25 to 30% dry matter results in high productivity whereas delayed harvesting at 35% dry matter reduced yields also leading to alternate bearing.
- ▶ Picking avocados when wet should be avoided as this increases the incidence of cold injury, pulp spot and lenticel damage.
- ▶ Fruit harvested in the morning or late afternoon tend to have less field heat.
- ▶ Color, size or oil content, generally serve as indications as to the most appropriate time for harvesting
- ▶ Postharvest disorders increase with the increase in storage time and temperature

PRE-PACKAGING TREATMENTS

a. Heat treatments

- ▶ It was observed that heating avocados at 38°C for periods of 24, 48 and 72 h improved the appearance and reduced the effects of chilling injury as opposed to untreated fruit
- ▶ Maximum ethylene evolution was also delayed without any change to the rate of respiration
- ▶ Weight loss was reduced as the number of days of heating increased leading to an improved shelf life
- ▶ To address the attack of insect pests in avocados, cold disinfestation is often used. This treatment requires exposing the fruit to a temperature of 1°C for 16 days but this induces chilling injury
- ▶ To alleviate the onset of chilling injury, heating the avocados for various duration and temperature regimes are applied
- ▶ Water is the preferred medium for most thermal applications as it is more efficient in transferring heat than air

b. Surface coating and wax treatments

- ▶ It is recommended to apply a fungicidal wash to control postharvest diseases such as anthracnose and stem-end rot in avocados. This is typically done before wax application
- ▶ Waxes were found to address the challenge of water loss due to their impermeability characteristic
- ▶ Waxing allows for water retention, increasing turgidity and maintaining fruit weight for longer periods

Packaging and storage methods

- ▶ The basic functions of food packaging are for storage, preservation and protection for prolonged periods of time
- ▶ The two most recognized techniques for avocados are modified atmosphere packaging (MAP) and controlled atmosphere storage (CAS)



Storage parameters

Temperature

- ▶ Temperature is the single most important factor to consider in storage of fruit due to its involvement in biological processes
- ▶ Low temperature storage reduces the rate of respiration and ethylene production resulting in retarded metabolic rates and an extended shelf life
- ▶ Theoretically, for every 10°C increase in temperature a resultant doubling in the rate of respiration occurs
- ▶ Optimal storage temperature: Hass' fruit are stored at 4 to 5 °C and other varieties at 6 to 8 °C.

Relative humidity

- ▶ Storing avocados at 10 to 20% relative humidity lost water three times faster than those stored at 90 to 95% relative humidity and 21 to 22°C
- ▶ Optimal humidity is 85-90%

Quality parameters

- ▶ Avocado is assessed on:
 - ▶ Changes in skin color,
 - ▶ firmness,
 - ▶ pH,
 - ▶ total titratable acid,
 - ▶ percent dry matter or oil content,
 - ▶ weight loss,
 - ▶ flavor
 - ▶ marketable quality

Processed products

- ▶ Uses of Avocado
 - ▶ Apart from fresh consumption as whole fruit and fresh fruit drinks, avocado is also used for the confection of baked products (such as cakes),
 - ▶ to elaborate fine soup mixes, appetizers
 - ▶ the production of cosmetics (oils, skin lotions, soaps, shampoos, etc.) due to its oil content.
- ▶ Avocado oil is appreciated because it contains biodegradable and easy to absorb sterol. The oil is sent to the United States, where it is refined and then sent to Japan and EU as edible oil and cosmetic ingredient.
- ▶ Besides being an important cosmetic ingredient, the pharmaceutical industry considers the unsaponifiable fraction of the oil as a valuable raw material. From this fraction, the factor H is extracted, which is used in the pet food and cooking oil industries
- ▶ **Types of products:**
- ▶ Frozen avocado - Original Chunky Avocado Pulp in 500g, 1kg, and 3kg plastic pouches.
- ▶ Avocado sauce- 100% Hass Avocado with minced onions and spices.
- ▶ Southwestern guacamole - Blend of chunky avocado, red bell pepper, onion, jalapeños and spices
- ▶ Non-refined avocado oil - oil is extracted from selected Hass avocados by mechanical processes

Points to note

- ▶ Know your product
- ▶ Adhere to required standards
- ▶ Branding and marketing
- ▶ Industry associations